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metric measures

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metric measures

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MADRAS

Metric System and Central Excises

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New Delhi

WHEN falling in line with the metric system of weights and measures, the Central Excise Department faces a difficult and complex task. With more and more need for finances for implementation of developmental plans, the activities and scope of this Department have also been rapidly expanding during the past few years. Quite a large number of commodities, as many as 26, are at present affected by the levy of Central excise duty. These commodities cover a very wide range indeed; most of them are of everyday use by the common man, for instance, fabrics, sugar, soap, matches, tea, tobacco etc. while there are others meant for a somewhat limited class of society, for instance, electric fans, motor cars, cement, mineral oils etc.

It will be relevant to mention that the primary unit for assessment of duty that has been adopted for different commodities provides an interesting variety, such as per square yard for cotton and rayon or artificial silk fabrics, but *ad valorem* for woollen fabrics; it is per lb for tea and coffee but per cwt for sugar, per ton for cement, per ounce troy for silver, per gross of boxes for matches and per fan for electric fans; it is per gallon for kerosene and motor spirit, but per ton for light diesel and furnace oils; and so on.

Problems of Conversion

All these different units of assessment have to be converted, wherever necessary, in terms of metric weights and measures. The arithmetical calculation is simple enough but the difficulty arises when we find that an exact equivalent of one square yard comes to 0·83612736 square metre and that of one lb works out to 0·45359243 kg. It cannot obviously be possible to have any tariff running into so many decimal points. It cannot also be possible to think of rounding off these figures to the nearest whole number which will mean making a material alteration in the rate of duty and which might be beneficial to the Government or the trade involving lakhs or even crores of rupees. While the Government cannot afford to lose any revenue, it will on the other hand be justifiably accused of bringing about enhancement in the rates of Central excise duties on the plea of carrying out adjustments of this nature. The problem, thus, is a ticklish one.

The Tea Board is reported to have decided to adopt the half kilogram (equivalent

to 1·1 lb) as the unit instead of the pound, and the units of sale reported to have been fixed by the Coffee Board are:

	Existing units	*New units*
(1) Pool, local and export sales (raw coffee) ..	1 cwt	50 kg
(2) Retail sales (raw coffee) ..	1 lb	½ kg
(3) Coffee powder	¼, ½, 1 lb	100, 200, & 500 g

The Development Council for Sugar Industry is reported to be planning to replace the standard packing of sugar which is at present 2 maunds and 30 seers by a bag of one quintal (100 kilograms), and the recommendation of the Technical Committee on Cement is that instead of marking the bag as 1 cwt gross, as done now, it should be marked 50 kg net.

Even if the unit adopted by the trade in respect of a particular commodity is accepted by the Government for the purpose of assessment of Central excise duty also, it is found that the corresponding rate of duty runs into decimal figures, for instance the existing tariff rate of duty on loose tea is 19 nP per lb and if calculated on the basis of ½ kg it comes to 20·94391236 nP. Such a rate of duty is out of the question.

Legal Questions

In respect of those excisable commodities, therefore, which are neither assessable on an *ad valorem* basis, nor with reference to whole numbers, the Government will have to find a unit of assessment which is not inconvenient to the trade practice and at the same time affords a workable rate of duty. This is bound to prove to be a complicated task, and whatever decision may be taken in this regard will have to be approved by the Parliament in the form of an amendment to the Central Excises and Salt Act, 1944.

That is not all. A number of rules of Central Excise Rules, 1944, will need amendment. Numerous Central excise forms, returns, registers, etc. will need wholesale revision. Weighing scales and measuring apparatus will have to be replaced or suitably altered. Thousands of Central Excise Officers working in every nook and corner, and even in the remotest parts of the country, will have to be adequately educated lest any error on their part causes heavy loss of revenue, and to enable them to give proper guidance to a very large number of illiterate licensees.

Change-over in 1960

The first phase of the reform having, however, commenced in respect of selected areas and selected commodities with effect from 1 October 1958, orders have already been issued that the Central Excise Licensees of cotton textiles, steel, cement, paper and coffee who choose to maintain accounts in metric units could do so but during the transitional period they should be required to show the figures in both the systems. It is necessary to continue to adopt the values in the existing system for all purposes of this Department for such time as all States adopt and enforce the new system. Then, there is movement of certain commodities from one State to another, and it is not possible to take any action which cannot have an all-India applicability.

In spite of many practical difficulties stated above the Central Excise Department is endeavouring to implement the scheme by April 1960, if other considerations permit.

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MADRAS

Metric System in Petroleum Industry

T. J. VARKIE

Burmah-Shell Oil Storage & Distributing Co. of India Ltd., Bombay

WEIGHTS, measurements, coinage—these are things which people take for granted very much like the air they breathe. These concepts are part and parcel of civilized man and when changes are introduced, they touch the very roots of his existence; but in a nation's march towards progress, changes from useful but out-worn methods to those which are more efficient must be undertaken.

The Government of India saw the need for a change in such a vital matter affecting the behaviour pattern of millions of people in this country and decided to do away with the different systems in current use and to introduce the metric system, which has now been adopted by over 70 countries. As a first step towards this change-over, decimal coinage was introduced on 1 April 1957. This was followed by metric weights on 1 October 1958 in certain specified areas of all States, in some Government Departments and in some industries in the public and private sectors.

The petroleum industry has day-to-day contacts with the Railways, Defence Services, Central Board of Revenue, Directorate-General of Supplies and Disposals and State Governments. The industry, therefore, decided that it should march together with allied Government bodies and public undertakings and implement the metric conversion simultaneously. Tentatively, the date has been fixed as 1 April 1960 when the petroleum industry as a whole will adopt the metric system completely in the entire network of petroleum distribution in this country.

It cannot be emphasized too strongly that an industry which operates throughout the country must have a uniform system of operation, a uniform system of sales and a uniform system of accounts. Operation of dual system is wasteful and involves all concerned in laborious, unproductive work. The petroleum industry, therefore, had to spend anxious days in detailed planning and phasing of the physical conversion of the various facilities.

Educational Programme

It was considered that the education of staff in the new concept should be the very first step in the change-over to the metric system. Accordingly, preparations of drawings, estimates, charts, specifications, instructions, manuals, standards, etc. were undertaken by the major oil companies in dual system. Staff at all levels are being

made familiar with the use of metric units. For the benefit of customers, various petroleum containers in use are being marked in metric and British units.

Physical Conversion

Briefly the storage and distribution system of the industry is as follows:

Refined petroleum products are carried in ocean-going tankers and pumped into large steel tanks at storage points called 'main port installations' or 'terminals'. From these main installations, products are sent in rail tankwagons to smaller upcountry installations for storage. The distribution is then carried on partly by road vehicles commonly known as tank lorries or tank trucks.

Let us see how the introduction of the metric system affects the various facilities involved.

Main Installation or Terminal Tanks

The depths of oil in storage tanks are measured by steel tapes. To assess the quantities involved, these measurements, called 'dips', are referred to calibration tables of the tanks concerned. Calibrations of tanks are normally carried out by the Central Public Works Department with the concurrence of the Port Customs, partly physically and partly by calculations from tank strapping data (circumferential measurement). The introduction of the metric system would mean that new calibration tables showing the depths in centimetres and quantities in litres instead of in feet and gallons as at present, should be prepared.

Upcountry Installation or Depot Tanks

Upcountry installation or depot tanks are calibrated by the oil companies themselves mostly by calculation from the dimensions of the tanks. Equivalent metric dimension will be used to draw up calibration charts in litres. A large percentage of these tanks have already been recalibrated and the petroleum industry does not anticipate any difficulty in having this completed before the target date.

Rail Tankwagons

There are at present in operation roughly 4,700 broad gauge and 2,300 metre gauge tankwagons in this country, the calibration tables of which are in the Imperial system only. It will be necessary to prepare calibration tables in metric units. This will be done either by physical recalibration or by recasting the existing tables in metric system with the help of standard conversion tables.

Tank Lorries or Tank Trucks

In the distribution network of the industry, tank lorries play an important part for delivering products to selling agents and customers. These road vehicles are filled to specified 'dips' witnessed and certified as corresponding to specified quantities by the Enforcement Sections of the Weights and Measures Departments of State Governments. The recalibrations of tank lorries would have to be undertaken by the Weights and Measures Departments of State Governments. In view of the gigantic labour involved, it may not be possible to complete this by 1 April 1960 in which case metric conversion tables approved by the Indian Standards Institution will be used.

Dispensing Pumps

The oil companies have in operation approximately 12,000 dispensing pumps of various makes and models for delivering petrol and diesel oil to motor vehicles throughout the country. The conversion of these pumps to a new system is a task of no mean magnitude which, if not properly handled, would cause much inconvenience to the public. The conversion equipment for these

pumps consists of several precision components, some of which will not yield to indigenous manufacture. Such parts will have to be imported.

It is proposed to carry out the physical conversion of dispensing pumps in as short a time as possible and it is estimated that the period of overlap of the current and metric systems will be about two months. The industry proposes to implement this conversion areawise, the exact details of which are yet to be finalized. The work of physical conversion will start earlier and finish perhaps later than 1 April 1960. After this date, however, all sales of petrol and diesel oil will be in litres and conversion tables will be used where pumps are not physically changed over to the metric system.

Weighing Machines

The industry uses a large number of weighing machines which come under different classifications, such as portable platform scales, self-indicating platform scales, etc. Except for a very small percentage, the weighing machines used by the industry are manufactured by the Avery Co. and conversion of machines to the new system will be undertaken by Avery Co. of India Private Ltd.

Flow Meters and Filling Measures

Pre-set meters and volumetric filling measures are used in main and upcountry installations for measuring the quantities filled in containers like 60 gallon, 45 gallon and 35 gallon barrels. The mechanisms of these meters are designed to indicate the quantities filled in gallons and certain parts should be replaced to convert them to litres. Such conversion parts will have to be imported. In the case of volumetric filling measures, there are provisions for adjustments and no difficulty is anticipated in resetting them to litre readings.

Containers

Over the years, the petroleum industry has developed a large variety of types and capacities of containers for packing petroleum products. These packages range in size from 60 gallon steel drums to ½ pint (1/16th gallon) tins. The industry proposes to make a thorough rationalization of all existing containers and to adopt the standards prescribed by the Indian Standards Institution for all future containers.

Sales and Accounting

Irrespective of whether all facilities are physically converted to metric units or not, it is proposed that the sales and documentation in the petroleum industry will change over to the metric system on 1 April 1960. The oil companies, financial year begins on 1 January and, in spite of some inconvenience, the date of 1 April has been chosen to coincide with the Government's financial year, when the allied Government Departments and public undertakings are expected to introduce the metric system.

Conclusion

The petroleum industry is faced with the enormous task of gearing up the entire distribution network to a new system within the limited period of one year from now. Preliminary work in this connection has been completed and the needs have been very carefully assessed.

Conversion parts for the various equipment will involve several items which cannot be indigenously manufactured. The imports of these are essential for the changeover but such imports will be kept at a minimum, in view of the country's difficult foreign exchange position.

The implementation of a scheme of this magnitude will undoubtedly entail difficulties and problems but with careful planning the industry hopes to be able to introduce the new system in time.

Enforcement Organization in France

GUY KNOCHE
French Economic & Technical Bulletin,
France

IT is fairly easy for a scientist or a group of them to devise a system of numeration but much more difficult to enforce such a system — no matter how reasonable and simple — on people accustomed to another system, even if the latter is complicated and unwieldy. However, this was just the task confronting succeeding French Governments in the years following the acceptance of the metric system by the French legislature. The difficulties encountered could be easily imagined when we remember that twenty years after the metric system had become law, the Napoleonic Government found it necessary in 1812 to authorize the use of the old measures alongside of the new and had to search for means of encouraging the use of the new measures.

With this intention, it was proposed to manufacture for commercial use weighing and measuring instruments calibrated in submultiples and multiples of the then most commonly used units. This led to the paradox that in spite of the avowed intention of accustoming the population to the new system, not only the use of the old units was permitted but to some extent a third system of so-called 'transitional' units was created.

These transitional units included, for the measurement of length, the fathom (2 metres), divided into 6 feet, with the foot divided into 12 inches and the inch into 12 lines. The aune, (1·20 metres) for the measurement of cloth, was divided into halves, fourths, eighths and sixteenths and into thirds, sixths and twelfths. Grain was measured by the double bushel (25 litres), the bushel (12·5 litres), the half bushel (6·25 litres) and the quarter bushel (3·125 litres). A mixture of half traditional and half metric system was produced for weighing with the pound, (500 grams), divided into 16 'onces', the once into 8 'gros', and the gros into 72 'grains'.

The least that could be said about this is that the institution of such a system jointly with the metric system was hardly propitious for extending the usage of the latter. Twenty five years later so little progress had been made that a new law was passed by the Chamber of Deputies, intended to make the metric system obligatory without any further transitional measures, except that a certain period was provided for eliminating all measures not in accordance with the metric system; this was to be the case by January 1840.

We might note in this respect that some of the deputies correctly evaluated the difficulties inherent in the problem of measuring. In 1837, a certain Monsieur Duprat noted

that 'at Bordeaux a whole hectolitre is used for measuring and is filled with the shovel. One hundred hectolitres shipped from this market produced 104 at Moissac, 103 at Montauban and 106 at Toulouse where one measures by arm span........' Other examples could be cited. Even so, the successive laws remained silent on the method of measuring and, to confine ourselves to one example, it was primarily through usage that the habit of using weight instead of volume prevailed for the measuring of grain and the quintal (100 kilograms) became substituted for the hectolitre.

However, the Decree of 28 March 1812 remains important not because of the creation of these transitional units but on account of the articles concerned with the control of weights and measures that included the following provisions:

Article 10 — In order to facilitate and regulate the manufacture of weights and measures, the use of which is authorized by this Decree, prototypes (models) will be sent to the departmental Prefects who shall place them in the safekeeping of the verification offices for the purposes of making them available as models to interested manufacturers and subsequently to serve as standards for the control of weights and measures in commercial use...Article 9 — The weights and measures referred to in the preceeding articles shall not be used commercially until they have been verified in the offices established for this purpose and stamped with the State Seal.

Along the same lines, the Law of 4 July 1837 contained the following article defining the role of the inspectors of weights and measures.

Article 7 — The inspectors of weights and measures shall determine and report infractions of the laws and regulations relative to the metric system of weights and measures. They may impound such weighing and measuring instruments when their use is prohibited by these laws and regulations. Their reports shall be accepted by the courts in the absence of proof to the contrary. The inspectors shall be sworn in by the competent court of their area.

The law of 2 April 1919 further extends the duties of the inspectors of weights and measures by entrusting them with the verification and inspection of all other instruments for measuring units legal in France including those of length, surface, volume and angle; mass and density; time; force, energy, power, pressure; electric resistance, intensity, potential and quantity; temperature and quantity of heat and cold; luminous intensity and flux, degree of illumination, magnifying power of optical lenses.

At present, the Decree of 30 November 1944 controls the application of metric weights and measures in France. Only organizational and control problems still require legislation. This is because the complete acceptance in France of the metric system by constant usage has eliminated the need for legislation and regulation in regard to the principle.

General Organization

Under article 1 of the Decree, the control of measuring instruments embraces the following fields:

The examination and testing of prototypes (models) of measuring instruments for approval of design and construction.

The initial verification of new and repaired instruments for conformity with the approved model and compliance with official specifications.

The periodic verification of instruments in current use for determining whether such instruments underwent initial verification and for ordering adjustment or withdrawal from service of those no longer conforming to official regulations.

The supervision of instruments in current use for compliance with legislative provisions, proper operating conditions and for correct and honest utilization by their owners and users.

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Who is entrusted with this task, the extent of which can be easily imagined and is evident from the series of figures which are quoted later on? Under Article 3 of the Decree, the verification of measuring instruments is provided by the Office of Weights and Measures. However, in certain cases, given types of instruments may be subject to control by other services of the Government or approved private organizations. To make the task possible, the country is divided into 10 regional districts grouping 35 division offices and 164 subordinate offices. Each office is equipped with standards calibrated in terms of the national standards.

Approval of Models

One of the primary tasks of the Office of Weights and Measures is the examination of instrument models designed by the various manufacturers. This is an important mission because, if instruments manufactured to conform with the submitted and approved model fail to function properly, only the initial verification of new instruments conforming with the model can result in a decision for revocation of approval.

Verification of Instruments

Obviously, two types of verification are required. The so-called initial verification which certifies that the new instrument conforms to the approved model and the periodic verification which determines whether the instrument functions properly and accurately. Both verifications are certified by the application of a stamp. Periodic verification takes place once a year in principle.

The sworn agents of the Office of Weights and Measures (now called Office of Measuring Instruments) are given extensive powers to carry out periodic verifications and cannot be refused, for instance, entry into rooms in which the instruments to be examined are kept. Any infraction of the regulations of weights and measures is made into a report which is transmitted to the judicial authorities and may result in a fine or imprisonment.

The Office of Measuring Instruments has also to carry out surprise inspections apart from the regular periodic verification to detect and prosecute the users of deliberately altered or non-standard instruments and those defrauding on the quantity of merchandise sold.

Article 27 of the Decree of 30 November 1944 further states:

> If posters, advertisements, catalogues, journals, labels or packaging indicate units of measure other than the denominations for the respective values listed in the table attached to the Decree of 26 July 1919, police officers and the agents of the Office of Weights and Measures are required to report such infractions...

The intent of the article is to provide for compliance with the metric system.

Activities of Office of Measuring Instruments

In a vast and modern country like France numerous measuring instruments of all kinds and types are constantly used. However, the personnel of the Office is quite restricted and consists of only about 400 employees who nevertheless accomplish a considerable amount of work. Every year the Office performs initial verification of 3,500,000 measures of length, 250,000 measures of volume, 1,500,000 weights, 250,000 scales (ranging from fractions of a carat to over 100 tonnes), 25,000 petrol pumps, 450,000 gas meters and 1,160,000 electric meters. In addition, for example in the year 1954, the Office calibrated 6,000 containers of various types with a total volume of 900,000 cubic metres which included 2,500 tank trucks, 1,200 tank cars, 1,650 storage tanks and 150 tank barges and tankers for river and high seas shipping.

The necessity for periodic verification is obvious. A measuring instrument may get maladjusted either accidentally (a simple violation) or through deliberate manipulation (an offense if the use of the instrument puts another party in a commercial transaction at a disadvantage). This verification is due in principle every year but generally made every two years only, and covers the small village grocer as well as a large public utility like the French National Railways. During one of the recent verification compaigns among 500,000 owners of measuring instruments, about 160,000 were found to be in possession of defective equipment. In addition, the certificate of verification was refused for nearly 400,000 instruments.

Again, during 1954, 35,000 out of 220,000 instruments which were due to be verified once a year, were subject to criticism. More than 500 infractions and nearly 200 offenses were reported. To complete our statistics, 50,000 out of 70,000 fuel distributors are verified each year as well as 5,500 railway car scales and 30,000 truck scales. For the verification of the last named, the Office of Measuring Instruments has designed test trucks specially adapted to this purpose.

Necessity for Inspection

The necessity for control and supervision is evident in everyday life. For example, French agriculture produces every year more than 100 million quintals of wheat representing several million times million francs. It is easy to see that any error in weight at the various stages of transactions would have important consequences either for the producer or the consumer. Very often, the requirements of modern technology necessitate assembly of components manufactured in places sometimes far distant from each other. If these components did not fit within very close tolerances, assembly would be impossible. This makes it a prime necessity for the manufacturers not only to use the same system of units of measure but also to use accurate instruments and to have this accuracy strictly controlled. The role of the Office of Measuring Instruments is to control the use of the system and ensure the accuracy of the instruments.

There can be no doubt such a service is an absolute necessity for a modern nation. Beyond the definitions of the units furnished by the scientists, we must take into account, in the practical application of a system of measures, the mechanical limitations of instruments (periodic verification) and also of human fallibility which require strict control (and punitive means) in the usage of the instruments.

* * *

India Adopts Metric System

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THE metric system of weights and measures has been accepted by most countries, and indeed in many of them it is the only legally permissible one. Now that India has taken her place amongst the nations of the world as a unified and independent Republic, it is in the national interest that the metric system is also adopted by us.

Men of science all the world over have long recognized the immense advantages following from the adoption of internationally accepted units for physical measurements of all kinds. Further, scientific research is by its nature international, and hence the adoption of agreed standards for all physically measureable quantities is essential for its progress.

Length, mass and time are the three irreducible entities accessible to physical observation which resist further analysis. Hence, the ideas and methods of science are directed towards expressing the measures of all other physical quantities in terms of the fundamental units of length, mass and time.

The initiative in establishing the units of measurement adopted for these purposes came from France in the years following the great political revolution in that country. Fortunately for the world of science, the scientific prestige of France at that time was very great. In every field of exact knowledge, she led the world and there was, therefore, no hesitation anywhere in accepting the lead thus given and thereby establishing the metric system as a universal basis of scientific description and measurement.

Universality of Scientific Units

The basic principle of the metric system is that the fundamental units should be derived from permanent and naturally existing standards. It was also contemplated that the subsidiary units actually used in practice should be related to the basic units in multiples or submultiples of ten, the computational advantages of the decimal system thus being availed of.

These objects have indeed been attained in the system, though not quite in the fashion originally intended. In practice, the standards actually used are certain internationally accepted prototypes, these being again reproduced as closely as possible in the national prototypes deposited in their respective countries.

With the advance of civilization, scientific knowledge and scientific results increasingly permeate all types of human activity. Machines of many kinds, mechanical and electrical energy, the artificial production of heat or cold, systems of illumination,

(*Continued on page* 21)

Metric System in Civil Engineering

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THERE should be no more hesitation in accepting the fact that the metric system of weights and measures has come to stay in India, since from 1 October 1958, Government of India has officially introduced it in different parts of the country.

For a long time the metric system has been popular with teachers and students of mathematics, science and engineering but at the present time, for a number of very good reasons especially for a rapid growth of our country's economy, it seems appropriate to adopt the metric system officially. In the present highly scientific and technological age, a system of weights and measures having the simplicity, convenience and scientific interrelations that the metric system possesses can no longer be denied its rightful place.

A civil engineer, among other people in various walks of life, is one whose work entails a large amount of measurements and calculations of weights. The implications of accuracy in computing with approximate data make it most urgent that, for a civil engineer, the system of weights and measures should be simple, scientific and universal.

The metric system being based on the decimal system, starts out with a convenient basic unit. The next larger unit is ten times as large, the next smaller unit one-tenth as small as the unit and so on. As a matter of fact, we can begin with any unit in the system and this same relationship holds. The same simplicity that we find in our decimal monetary system is found in the metric system of measurements for weight, length, volume and temperature.

Measurement of Length

Measurement of length is of primary importance to a civil engineer and the accuracy of such measurements is very often directly related to the system of measures adopted. Thus if a length measures 1 ft $2\frac{3}{8}$ in, it can only be represented in decimals by 1·1979..ft, which is seemingly complicated. On the contrary, a length measured as 1 cm 2·25 mm can be easily represented as 1·225 cm, and this measurement is evidently much more accurate and finer than the former.

Measurement of Area

In the case of measurement of areas, with which a civil engineer is very often concerned, the error in linear measurement introduces an error in area which is proportional to the square of the linear error.

Measurement of Volume

Similarly, the measurement of volume will be subjected to an error in the proportion of the cube of the linear error. Thus

an area 1 ft 2 in×1 ft 2 in works out to 1·361 sq ft approximately and a volume 1 ft 2 in ×1 ft 2 in×1 ft 2 in represents 1·587..cu ft approximately. On the other hand, an area 1 cm 2 mm×1 cm 2 mm is equal to 1·44 sq cm and a volume 1 cm 2 mm×1 cm 2mm×1 cm 2 mm represents exactly 1·728 cu cm.

Let us take a problem in computing volume. It will show clearly the contrast between a fractions system and a decimal system. Here is the problem in English system: Find the volume in cubic feet of a tank 4 ft $9^5/_{32}$ in long, 2 ft $3^7/_{16}$ in wide and 1 ft $11\frac{3}{4}$ in deep. In metric measurements the problem is: Find the volume in cubic metres of a tank 145·89 cm long, 68·98 cm wide and 60·33 cm deep. The solution of the English problem involves two different operations of conversion of inches into feet and of multiplying a fraction times a fraction. The solution of the metric problem involves only straight multiplication of three decimal numbers, *viz*: 1·4589 m ×0·6898 m×0·6033 m. Then too consider the time involved. An engineer will be able to solve more problems in the metric system in the time required to solve one problem in the English system.

Measurement of Pressure

The same simplicity is observed in the measurement of weights in the metric system and this is a real advantage to the civil engineer engaged in the design of hydraulic structures. In the English system, 1 cu ft of water weighs 62·4 lb and a foot of hydrostatic head of water exerts a pressure of 62·4 lb per sq ft. Whereas, in the metric system 1 cu cm of water weighs 1 gram and a metre of hydrostatic head of water exerts a pressure of 1,000 kilograms per sq metre. Furthermore, when the unit weight of any material is expressed in metric system, *viz*: g/cc, straightaway it gives an idea of the density and specific gravity of the material, and as such, it is very useful to a civil engineer working in the fields of soil mechanics.

Estimating Cost of Works

Estimating the cost of works is a very important part of the civil engineer's profession, and this again calls for an essentially simple and accurate process of working. Let us work out a problem in figuring costs, starting with corresponding units and determining the cost for smaller units.

If 1 metric tonne costs Rs. 25,000 then 1 kilogram costs Rs. 25·00, and 1 gram costs Re. 0·025.

But if 1 long ton costs Rs. 25,000 *then* 1 lb costs Rs. 11·16, and 1 oz costs Re. 0·6975.

As a metric tonne contains 1,000 kilograms, all we need do is to shift the decimal point three places to the left and so on. On the contrary, in the English units one long ton contains 2240 lb, and we are forced to solve a problem in long *division* and even then the result will be approximate. Again in determining the cost of plain areas, the metric system is more advantageous than the English system. For example, if 1 square metre costs Rs. 100, then 1 sq cm costs 1nP *i. e.* Re. ·01. But if 1 sq ft costs Rs. 100, then 1 sq in costs Re. $^{100}/_{144}$ *i.e.* Re. 0·69.

From what has already been said, it is obvious that a civil engineer will save himself time and complications in works if he chooses to adopt the metric system. The metric system of measures is standard and, therefore, a civil engineer can follow the works carried out in other parts of the world with much simplicity and uniformity.

Simplification of Units

A civil engineer engaged in the fields of water supply, sanitary or irrigation engineering has to deal with units like 'Cusec' 'Cfm' or 'Gpm' for determining discharges through closed pipes or open channels. Determination of these data accurately is the first step towards a successful design. These units in English system denote 'cubic feet per second', 'cubic feet per minute' and 'gallons per minute' respectively. In metric system, these units are expressed as 'litres per second' and 'litres per minute'. Obviously this means much simplification over the English system, and since 1 cu cm equals 1 millilitre and 1,000 millilitres make 1 litre, the measurement of volume is a direct indication of the capacity.

Another important unit is the 'friction head' and this is usually expressed in the English system as 'feet per 100 ft of pipeline or channel'. This can also be easily expressed in the metric system as 'metres per 100 metres of length of pipe or channel'. The capacity and size of pumps used for water supply, sewerage or irrigation purposes need only be expressed in relevant metric units, *e.g.* French Horse Power, where 1 French Horse Power=75 kilogram metres per second =0·9863 British Horse Power.

Design and Planning of Structures

The most important part of a civil engineer's profession is the design and planning of structures, small or large, for various purposes. A civil engineer engaged in design and planning has to start off with certain basic data, and he has no difficulty in switching over to the metric system while determining these basic data. Let us illustrate this by the working of designs in the English and metric systems respectively by means of the following example of a simple beam.

English System

A beam of span 10 ft is freely supported at two ends and carries a uniformly distributed load of 100 lb per linear foot. Find the required section modulus for the beam, assuming allowable maximum stress=10 tons per sq in.

Maximum bending moment=

$$\frac{100\times10\times10}{8}\text{ ft lb}=1250\text{ ft lb}$$

$$=1250\times12\text{ lb in}=\frac{1250\times12}{2240}\text{ T-in}$$

$$=375/56\text{ T-in.}$$

$$=6\cdot7\text{ Ton-inches(approx)}$$

Therefore, the required section modulus

$$=6\cdot7/10\text{ in}^3.$$

$$=0\cdot67\text{ in}^3.$$

Metric System

A beam of span 10 metres is freely supported at two ends and carries a uniformly distributed load of 100 kg per linear metre. Find the required section modulus for the beam, assuming allowable maximum stress =1600 kg/cm^2.

Maximum bending moment as before,

$$=\frac{100\times10\times10}{8}\text{ kg. metre.}$$

$$=1250\text{ kg. metre}$$

$$=125000\text{ kg. cm.}$$

Therefore, section modulus$=\frac{125000}{1600}$ cm^3 $=78\cdot125$ cm^3.

Scales for Drawings

Thus, the advantage of the metric system is very great to a civil engineer engaged in structural designs. While reproducing the works of design or surveying on drawings, an engineer has to consider carefully the most suitable scale for the drawing. In the English system various scales are used for structural drawings *e.g.* $\frac{1}{8}$ inch to a foot; $^1/_4$ inch to 1 foot; $\frac{3}{8}$ inch to 1 foot; $^1/_2$ inch

to 1 foot; $\frac{3}{4}$ inch to 1 foot; 1 inch to 1 foot; and so on. Again, for survey plans scales may be 1 mile to 16 inches; 200 ft to 1 inch; 100 ft to 1 inch; 50 ft to 1 inch; 20 ft to 1 inch and so on. One can easily realize the impact of such a hotch-potch system of scales on the mind of the draughtsman who has to produce the drawings accurately and within a specified time. It is, therefore, not very abnormal that the draughtsmen in our country take more time to produce a specified number of drawings, because they have to devote much of their working time to select and use different scales or else they would get confused in the complexities of endless number of scales. In the metric system, however, one has to use only one scale for either structural drawings or survey plans, the ratio between any two of whose consecutive units is 10 or some multiple of 10.

Advantages of 'Tenths' System

We are now using two seperate systems of measurements for weight, length, volume and temperature, when only one system is all that is necessary for carrying on any or all of our civil engineering activities. The explanation for this lack of action is in all probability due to the fact that we have grown up with it and, therefore, have accepted it without questioning. We were obstrusively taught to use one system, the English system, and the other, the metric system, has come in by a slow process. Evidently, it is only interia that fills our minds with some imaginary horror, when we are called upon to use the metric system of measures. The English system is a 'fractions' system while the metric system is a 'decimal' system. When we discard the English system, we shall for all practical purposes have eliminated 'fractions' as such, from education. True, we shall still use fractions to express relationships in formulae and to indicate division problems, but otherwise fractions will pretty well disappear. Even those who follow market quotations will find the 'tenth' in decimal form more adaptable to their needs than the fractions now used, and since we have already a decimal coinage system in vogue, the metric system of measures is a real advancement in all our scientific and engineering works. It is not a question of the relative merits of either system. That leads to endless and largely futile argument. The problem is rather whether it will pay to have a uniform system of measurement not only for its effect on trade, but also to prevent loss and confusion due to having two systems in use and also to increase the pace of progress of our national development schemes.

Kilogram in Different Languages

MANY people believe that the nomenclature adopted for metric units in India, namely, kilogram, metre, litre, etc. is English. This is not correct. The following are examples of how 'kilogram' is spelt or pronounced in some of the languages of the world.

English	kilogram
Finnish	kilogramma
French	kilogramme
German	kilogramm
Italian	chilogramma
Japanese	pronunciation is 'kirogramu'
Siamese	pronunciation is 'kilogram'
Spanish	kilogramo
Swedish	kilogram

It is of interest to note that the terminology derived from Greek and Latin is used internationally by practically every nation that has adopted the metric system. Countries like Egypt, Ethiopia, Iraq, Iran, Japan, Indonesia, Thailand, Brazil, France, Germany, Turkey, Russia — all use the same terminology, the peculiarities of pronunciation making some contribution to the variation.

Of course, pronunciations in the Indian languages may also make some contribution of their own. Already, an eminent gentleman has expressed the view that the Indian genius may turn kilo and milli into Kallu and Mallu!

* * *

Students and Conversion Tables

MANY of us have learnt conversion tables for weights and measures by heart in our childhood days only to find that the tables we so devotedly committed to memory were of little use away from our hometowns. Perhaps, in order to rectify this situation and in their anxiety to make children wiser and to simplify their work when they go to other cities, some manufacturers of exercise books used to give, and still continue to reproduce, tables of weights and measures on the back covers of the exercise books. These tables are perhaps intended to give a cross-section of the prevalent systems and are useful mostly in confusing not only the children but even the grown ups. The following is an example of the type of tables given in children's exercise books. How many of these systems do you know?

TABLES OF WEIGHTS AND MEASURES

INDIAN BAZAAR WEIGHT

4 Sikis	= 1 Tola
5 Sikis	= 1 Kancha.
4 Kanches or 5 Tolas	= 1 Chatak.
4 Chataks	= 1 Powah
4 Powahs	= 1 Seer.
5 Seers	= 1 Pasari
8 Pasaris or 40 Seers	= 1 Maund

JEWELLER'S WEIGHT

4 Dhans	= 1 Rati.
6 Ratis	= 1 Anna.
8 Ratis	= 1 Masha.
12 Mashas or 16 Annas	= 1 Tola. or Bhari.

INDIAN TIME

60 Anypal	= 1 Vipal.
60 Vipal	= 1 Pal
60 Pal	= 1 Dundo
60 Dundo	= 1 Deen.
7 Deen	= 1 Hafta.
30 Deen	= 1 Mahina
12 Mahina	= 1 Baras.

INDIAN LIQUID MEASURE

4 Chataks	= 1 Powah
4 Powahs	1 Seer
40 Seers	= 1 Maund.

INDIAN MONEY TABLE

3 Pies	= 1 Pice
2 Pice	= 1 Half-anna
6 Pies	= 1 Half-anna
4 Pice	= 1 anna
12 Pies	= 1 anna.
16 Annas	= 1 Rupee

INDIAN MONEY TO STERLING

1 Anna	= 1 Penny.
12 Annas	= 1 Shilling
1 Rupee	= 1 Shilling & 6 Pence
13 Rupees & 5 Annas	= 1 Pound

CEYLON MONEY TABLE

100 Cents	= 1 Rupee

BENGAL BAZAAR WEIGHT

5 Chataks	= 1 Kunka.
2 Kunkas	= 1 Khunchi
2 Khunchis	= 1 Rek
2 Reks	= 1 Pali.
2 Palis	= 1 Done.
2 Dones	= 1 Kati.
8 Katis	= 1 Arhi.
20 Arhis	= 1 Bish
16 Bishes	= 1 Kahan.
16 Palis	= 1 Maund
8 Dones	= 1 Maund
20 Dones	= 1 Sali.

BENGAL LINEAL MEASURES

3 Jaubs	= 1 Anguli.
4 Angulis	1 Musti.
3 Mustis	= 1 Bitasti.
2 Bitastis	= 1 Hat
2 Hats	= 1 Gaz.
2 Gazes	= 1 Dhanu.
2000 Dhanus	= 1 Kosh.
4 Koshes	= 1 Yojan

BENGAL GRAIN MEASURE

5 Chataks	= 1 Koonkee
4 Koonkees	= 1 Raik.
32 Raiks	= 1 Maund

BENGAL PHYSICIAN'S WEIGHT

4 Dhans	= 1 Rati.
10 Ratis	= 1 Masha.
12 Mashas	= 1 Tola.

BENGAL CLOTH MEASURE

3 Angulis	1 Girah.
8 Girahs	= 1 Hath.
2 Haths	= 1 Gaz.

BENGAL MEASURE OF LAND SURFACE

20 Square Cubits(or Gandas)	1 Chatak
16 Chataks	= 1 Katha.
20 Kathas	= 1 Bigha.

BOMBAY BAZAAR MEASURES

36 Tanks	= 1 Tipari
2 Tiparis	= 1 Seer
4 Seers	= 1 Payli.
16 Paylis	= 1 Phara.
8 Pharas	= 1 Kandi.
25 Pharas	= 1 Muda.

BOMBAY MEASURES OF LAND SURFACE

39¼ Square Cubits	= 1 Kathi.
20 Kathis	= 1 Pand.
20 Pands	= 1 Bigha.
6 Bighas	= 1 Rukeh.
20 Rukehs	= 1 Chahur.

BOMBAY CLOTH MEASURE

2 Angulis	= 1 Tasu.
24 Tasus	= 1 Gaz.

MADRAS LOCAL WEIGHT

180 Grains	= 1 Tola.
3 Tolas	= 1 Palam.
8 Palams	= 1 Seer.
5 Seers	= 1 Vis.
8 Vis	= 1 Maund
20 Maunds	= 1 Kandi.

MADRAS BAZAAR MEASURE

8 Ollaks	= 1 Paddi.
8 Paddis	= 1 Markal.
5 Markals	= 1 Phara.
80 Pharas	= Garee.

UNITED PROVINCES MEASURE OF LAND

20 Kachvansi	= 1 Bisvansi
20 Bisvansis	= 1 Bisva.
20 Bisvas	= 1 Bigha.

PUNJAB MEASURE OF LAND

9 Sarsi	= 1 Marla.
20 Marlas	= 1 Kanal.
4 Kanals	= 1 Bigha.
2 Bighas	= 1 Ghuma.

BRITISH AVOIRDUPOIS WEIGHT

16 Drams	= 1 Ounce.
16 Ounces	= 1 Pound.
14 Pounds	= 1 Stone.
2 Stones	= 1 Quarter.
4 Quarters	= 1 Hundredweight
20 Hundredweights	= 1 Ton.

CAPACITY

4 Gills	= 1 Pint.
2 Pints	= 1 Quart.
4 Quarts	1 Gallon.
2 Gallons	= 1 Peck.
4 Pecks	= 1 Bushel.
8 Bushels	= 1 Quarter.

BRITISH LINEAL MEASURE

12 Inches	= 1 Foot.
3 Feet	= 1 Yard.
5½ Yards	= 1 Pole.
40 Poles	= 1 Furlong.
22 Yards	= 1 Chain
10 Chains	1 Furlong.
8 Furlongs	1 Mile.
1760 Yards	= 1 Mile.

TABLE

4 Farthings	= 1 Penny.
12 Pence	= 1 Shilling.
20 Shillings	= 1 Pound.
2 Shillings	= 1 Florin.
2 Shillings & 6 Pence	= 1 Half-crown.

BRITISH MEASURE OF LAND

144 sq.Ins.	= 1Sq. Foot.
9 Sq. Feet	= 1 Sq. Yd.
1210 Sq.Yds.	= 1 Rood
4 Roods	= 1 Acre.
640 Acres	= 1 Sq. M.

BRITISH TABLE OF TIME

60 Seconds	= 1 Minute.
60 Minutes	= 1 Hour.
24 Hours	= 1 Day
7 Days	= 1 Week
4 Weeks	= 1 Month
12 Months	1 Year.
365 Days	= 1 year
366 Days	= 1 Leap year.
52 Weeks	= 1 Year.

News and Views

Pricing of Products

THE Indian Tube Company Ltd., have announced the prices of steel tubes in terms of metric units and decimal coinage. The prices are now quoted in Rupees and nP per metre. Previously they were quoted per foot length of pipe. The factor given by the company is 1 metre=3·281 ft.

The Indian Tube Company have taken a step in the right direction and this type of conversion of prices is now essential and will save manufacturers and sellers considerable time later on, if they take the earliest opportunity to convert their prices to metric units and decimal coinage.

Decimal System in Politics

Speaking at one of his meetings, Acharya Vinoba Bhave said that the people represented one and the Government zero. Separately they would not achieve much. But jointly if they stand together their achievements and power would be tenfold!

Metric System in Japan

It has been reported that from 2 January 1959, the metric system has come into force in Japan.

The conventional Japanese measurements and the yard-pound system have been prohibited for all transactions, except for those specially exempted.

Any violation will be subject to a fine of not more than Rs. 700.

The new system, however, only applies to the 'transaction' stage, and not to 'production' or 'consumption' stage. In other words, the old measurements can still be used at factories and plants among farmers and at general households.

The old measurements will be used until 31 December 1960 for some specified items.

The yard-pound system will be used until the same date for general export and import merchandise, arms, goods for foreigners' use, air traffic control and oceanographic survey data.

International Nomenclature

In a recent issue of 'Bulletin de Metrologie' the following paragraphs have appeared regarding the adoption of international nomenclature for the metric system in India.

'In an article entitled 'Why not Indian Names for Metric Weights and Measures' published in the journal *Metric Measures*, Vol. 1, No. 6 (November 1958), page 3-5, Mr. K. V. Venkatachalam, Joint Secretary, Ministry of Commerce and Industry, New Delhi, says that the question of denominations for units has been the subject of deep consideration by a number of organizations in India and that the conclusion has been in favour of international terminology.

'We can only congratulate our colleagues in India over this wise decision. We hope that even in Indian scripts they would maintain the Roman character for the symbols of the units of measure, even if it be necessary to enlarge the key-board of typewriters to achieve this.'

Measurement of the Rotation of the Earth

It has been reported from London that the House of Commons was told that an atomic clock in Britain has indicated that the rotation of the earth, which has been slowing down for several years, is speeding up again.

A member had asked to what extent research at the UK National Physical Laboratory had shown that the earth was rotating irregularly.

Mr. Harmar Nicholls, Parliamentary Secretary to the Ministry of Works, said measurements to an accuracy of one second in 300 years had been carried out at the laboratory on the so-called atomic clock.

These, when compared with astronomical measurements of time, showed that the earth turned slightly faster during our summer and slightly slower during our winter.

Unit for Wholesale Prices of Coffee

In the January 1959 issue of *Indian Coffee* it has been reported that the Chairman, Coffee Board, in his address to the Board on 21 January 1959, said:

'The metric system was brought into force from 1-10-58 in regard to the Board's transactions, mostly pertaining to stocking and sale of coffee. From the 2nd week of December prices are being quoted for units of 50 kilograms as this was found more convenient.'

Another feature of the address was that the estimates of the crops and other quantities of weights were given in metric units only.

Decimal Coinage and Metric System

The question is often asked whether the decimal coins so far issued, namely, 10, 5, 2 and 1 naye paise are related by weight to the metric system, as the old coins were related by weight to the tola. The fact is that the new coins when freshly minted, have definite weights in terms of grams as follows:

10 nP	..	5 grams
5 nP	..	4 grams
2 nP	..	3 grams
1 nP	..	1·5 grams

When the new coins for 25 nP, 50 nP and Re. 1 are minted they would have the following weights on minting :

1 Rupee	..	10 grams
50 nP	..	5 grams
25 nP	..	2·5 grams

It may be mentioned that the old rupee, when freshly minted used to weigh one tola (180 grains) and the half and quarter rupee coins, 90 grains and 45 grains respectively; 2 anna piece was 90 grains and one anna 60 grains and half anna and pice 45 grains each.

World Population Using Metric System

How many people in the world use the metric system as the only system of weights and measures ?

It is well-known that almost every country in the world uses the metric system either optionally or compulsorily. The principal countries in which the metric system is not compulsory are Australia, Burma, Canada, Ceylon, Ireland, Nepal, New Zealand, Pakistan, Union of South Africa, United Kingdom and USA. There are other smaller countries which do not use the metric system to a large extent.

On the basis of the Demographic Year Book, 1957, of the United Nations, it is estimated that a population of nearly

440 million do not use the metric system. The population of the world according to this source is estimated at 2,737 million. Thus the metric system is being used by about 85 per cent of the population of the world.

Mathematics in the School

The issue dated 8 February 1959 of '*Link*' Indian Newsmagazine, published from New Delhi, has the following to say:

'Geoffrey Lloyd, Britain's Minister of Education, has his own explanation why his country's scientists, technicians and engineers are not pulling their full weight with the rest of the Western powers in the race for scientific supremacy. He attributed this lag to the time-worn methods employed in the teaching of mathematics at school. The highest common factor and the least common multiple continue to haunt young Britons. In an introduction to a booklet, the Minister suggests that a stage has been reached when teachers should seriously think of fresh methods and a more sensible curriculum. Long sequences of mechanical exercises and the patient plodding through them continue to be the stock-in-trade of lessons in mathematics.

'*Wrong Approach*—Britain has started with a programme of fitting mathematics to the pupil rather than attempting to stifle the young aspirant by trying to fit him into an arbitrary device of quadratic equations and the like. The Minister suggests that there is a rarity of good teachers of mathematics because, mankind's greatest cultural achievement, namely mathematics, has been very wrongly approached.

'In India today, almost a year after the introduction of the decimal coinage, our little ones have to plod through problems full of annas and pies, even of shillings and pence.'

* * *

INDIA ADOPTS METRIC SYSTEM

(*Continued from page 12*)

electrical communication, radio and television may be mentioned as illustrative examples.

All of them involve accurate measurements of some kind or other, and hence it is inevitable that the system of units which scientific men have adopted for their own purposes penetrates into other fields and thus become universal. This is a highly desirable result and the nation may, therefore, rightly acclaim and adopt the sysem with enthusiasm.

Readers' Forum

IN a letter to Shri K. V. Venkatachalam, Joint Secretary, Ministry of Commerce and Industry, New Delhi, M. Costamagna, Directeur du Bureau International de Metrologie Legale, Paris states:

'I just read your article entitled 'Why not Indian Names for Metric Weights and Measures', in the November issue of the magazine *Metric Measures* and I take the liberty of congratulating you because you are perfectly right in saying that the names of metric measures must not be 'Indianized' and that the new measures should not be given names recalling the old ones, particularly in a country adopting the metric system for the first time. On the contrary, they must be brought to the attention of all, using special terms, (these should not be too complicated.)

'This last experiment was carried out in France where the metric system was created and made compulsory in 1795, and where its adoption took a very long time. One of the reasons for this was precisely the newness of the Greco-Latin terms used, 'metre' 'kilogram' etc. (The wits and cartoonists poked much fun at the new terms.)

'Napoleon, the Emperor, thought he could solve this difficulty when he decided by decree on 12 February 1812, to authorize calling the new metric measures by the names of old measures: 2 metres=1 Toise; 500 grams=1 Livre (Metric lb); 1/8 Hectolitre=1 Boisseau.

'These new measures were in fact: (1) multiples or simple parts of the metric measures; (2) nearly equivalent to the old measures. On the other hand, what was serious, the authorization of splitting them in halves, quarters, twelfths, sixteenths etc., was given.

'The result was disastrous because three systems came into force instead of two.

(1) The old measures still in use in the provinces.

(2) The Napoleonic measures adopted by the small businesses and small industry in the cities.

(3) The metric measures taught in schools and in compulsory use by the administration and the heavy industry as well as in the Public Registers.

'It was extremely difficult to remedy this situation which was only dealt with 25 years later when King Louis-Philippe signed an energetic order prohibiting even the casual recall of the names of the ancient measures.

'I do not know if you were aware of this mishap which befell the metric system, but I am happy to note that India is careful not to face the same difficulties.'

(Indian Standards which have a particular bearing on the change-over to the metric system are indicated here. Copies would be available from the Indian Standards Institution, Manak Bhavan, 9, Mathura Road, New Delhi or their branch offices at Bombay, Calcutta and Madras)

Modular Planning Design and Construction in Building Industry

Shri A. K. Chanda, Deputy Minister for Works, Housing and Supply, presided over the Session on Modular Planning, Design and Construction in the Building Industry in the Indian Standards Convention at the ISI Headquarters, New Delhi on 27 November 1958.

Opening the Session, Shri Chanda remarked that a module is a basic unit of length in terms of which dimensions of building materials and building components are expressed. This dimensional relationship between components makes it possible to fit them with each other in various manners without undergoing the expense of cutting and wasting of material and labour at site.

Among the advantages of systematic introduction of modular co-ordination, Shri Chanda mentioned:

(1) Manufacturers of building materials and components can limit themselves to fewer standardized products, thereby eliminating many odd sizes.

(2) Material dealers can carry smaller inventories and assure better service and customer satisfaction.

(3) Architects can save time on drafting and spend more time on improving design.

(4) Contractors can make quicker and more reliable estimates and can save time and materials on the construction job.

Pointing out the substantial saving that will occur if systematic modular planning and design was carried out, Shri Chanda drew attention to the enormous amount of money to be spent on housing in the Second Five-Year Plan, and the substantial saving of 300 million rupees that would result even if a 10 per cent saving was achieved with the introduction of modular co-ordination. He said that with the savings we could build more houses so that more families could have homes to live in. He appreciated the work done by the ISI which had taken a lead during the last seven years and had wisely introduced the modular system by standardizing the common building brick, building stones, flooring tiles, doors, windows and other components.

After introduction of the five papers which had been presented to the Session by the Discussion Leader, Shri N. B. Shroff of the Railway Board, discussion ensued which brought out clearly the principle of modular planning, the adoption of 10 cm module which fits in with the metric system introduced in the country; the method of application of the module to standardization of dimensions of building materials and components, and also in

actual building construction work. The advantages of adopting modular planning in the design of specialized buildings, libraries, hospitals etc. were also emphasized. The Session was of the unanimous view that modular co-ordination has great benefits to offer to the building industry in particular and to the country at large in saving in building cost substantially, which may even go up to 20 per cent, and at the same time would ensure that standardization preserves necessary individual and personal character of the new architecture that would emerge using standardized components. It was pointed out that modular co-ordination was only a means to an end, which is the achievement of substantial economies in construction work and not an end in itself.

The Session felt that following the example of the Building Research Institute, Roorkee, which had attempted to introduce a precast manufactured house planned according to modular system, other experiments should be made in various parts of the country wherein modular planning and construction may be tried out so that people become modular conscious and there was wider application of modular planning, design and construction in the country.

Standardization for Saving Steel

A Session on Steel Economy was held on 26 November 1958 as a part of the fourth Indian Standards Convention, held in New Delhi. In the absence of Sir Jehangir Ghandy of Tata Iron & Steel Co., Ltd., Jamshedpur, Shri S. L. Kumar of Indian Railways presided over this Session, which was attended by about 250 delegates. Six technical papers dealing with the various aspects of achieving steel economy came up for discussion which was lively and interesting. The work so far done by the Indian Standards Institution in formulating Indian Standards for saving steel drew appreciation from the delegates. Apart from the suggestion to use alternative types of constructions with reinforced cement concrete, the use of prestressed concrete was advocated. It was suggested that timber could be used to a large extent in structures. The delegates from the Forest Research Institute, Dehra Dun pointed out that instead of 3 or 4 conventional types of timber now used in the country, 89 species of timber could be used in all types of structures with spans ranging from 8 ft to 300 ft after proper treatment of the timber and by using improved methods of jointing.

It was suggested that the sale of so-called untested steel should be discouraged and as far as possible work-tested and certified steel only should be put on the market. The advantages, limitations and economy of steel in the use of steel tubes and light gauge sections in structures were brought out. Improved types of reinforcement such as deformed and cold twisted bars for use with cement concrete were suggested.

The advantages of welding instead of riveting in saving steel were enumerated and it was suggested that only trained welders should be encouraged for all welding work. It was also stressed that more and more schools for training of welders should be started and the newly published Indian Standard Specifications and Codes of Practice in the field of welding should form a part of the education curricula of the various technical institutions in the country. Considerable stress was laid on the need for adopting the new Indian Standards, both in the public and private sectors of the industry to effect the desired widespread economy in the production and utilization of steel.

Draft Indian Standard Specification for Metric Surveying Chains and Bubbles [Doc : EDC 36 (463) and Doc : EDC 36 [(420)]

The Indian Standards Institution has drafted the following two Indian Standards for wide circulation amongst the parties concerned for eliciting their comments.

(1) Specification for Metric Surveying Chains [Doc: EDC 36(463)], which covers the requirements for link type surveying chains of 20 m and 30 m lengths, used in land measurement.

This standard confines itself to link type surveying chains of 20 m and 30 m lengths. It is one of a series of Indian Standard Specifications for surveying instruments, being prepared by the Institution in connection with the change-over to the metric system. The other standards under formulation in the series cover:

Levelling Staves,

Prismatic Compass, and

Metric Scales.

(2) Specification for Bubbles [Doc: EDC 36 (420)].

This standard specification covers bubbles, ground, unground and moulded fabricated, either in cylindrical or circular form, intended for use in precision or surveying, inspection and general levelling purposes.

The bubble is an instrument that defines a reference horizontal plane in levelling. It consists of a glass tube containing a filling liquid having low viscosity, and which can maintain its fluidity over a fairly wide range of temperatures, thereby making its use possible at low temperatures as well.

Draft Indian Standard Code of Practice for Steel Bridges

[Doc : BDC 14 (297)]

The Indian Standards Institution has prepared a draft Indian Standard Code of Practice for Steel Bridges [Doc: BDC 14(297)] which is being circulated to all interested parties for eliciting comments. This code of practice is primarily intended to apply to the superstructure of simply supported steel bridges of spans (effective) up to 125 m (or 400 ft). Where appropriate, the requirements of the code can be adopted for larger spans or other types of steel bridges.

The provisions of this code apply mainly to the design, fabrication and erection of new bridges. When the existing railway bridges are checked for permissible loads, or while alterations are being undertaken, the designer may check them according to the I.R.S. Steel Bridge Code. While it is not obligatory for the designer to adopt the stresses or details specified in this Code in checking existing railway bridges where the code is adopted, the bridge shall be required to comply with all the provisions of this Code.

Most steel bridges in India have been constructed by the Indian Railways and the Steel Bridges Codes of the Indian Railways together with Bridge Rules and other publications have governed the design and construction of steel bridges in this country generally. The Roads Wing of the Ministry of Transport and Communications has been following hitherto a Draft Code prepared by the Indian Roads Congress. Except for the requirements for approaches, design of the pavements or decking and such other considerations which distinguish railways from roadways, practices in the design and construction of steel bridges have been to a substantial extent

similar. This Draft Code on Steel Bridges unifies fully the practices followed by the Indian Railways and the Indian Roads Congress and takes into consideration the requirements of other departments such as Defence etc.

Draft Indian Standard Specification for Commercial Refrigerators [Doc : BDC 18 (377)]

Commercial refrigerators are finding increasing application in storage operations. Proper storage facilities are essential in preserving the quality and appearance of foodstuffs. Till recently refrigeration industry in India had not made much head-way, and majority of the parts were being imported and units assembled in India. But during the last few years, the industry has made rapid strides and at present most of the components are being made indigenously excepting hermetically sealed and semi-sealed compressors. It is necessary that these indigenous units should conform to certain minimum standards, so as to ensure satisfactory performance, efficient and sound operation under weather conditions existing in India.

Taking into consideration the present state of air-conditioning and refrigeration industry in the country, the ISI has drafted an Indian Standard Specification for Commercial Refrigerators [Doc: BDC 18(377)]. The standard prescribes the general requirements of refrigerating cabinets within the range of 0·35 to 2·85 cu m (or 12 to 100 cu ft) net internal volume and operated by an electrically-driven refrigerating machine of the vapour compression type. It also specifies methods of carrying out type tests of performance and ratings on selected units. The limits of internal and ambient temperatures covered by this standard are:

Internal Cabinet Temperatures —20·5° +4·5°C(—5°F to 40°F).

Ambient Temperatures+43·5°C(+110°F)

Draft Indian Standard Specification for Asbestos Cement Building Pipes and Fittings and Pressure Pipes [Doc: BDC 2 (342) and Doc: BDC 2 (346)]

Asbestos cement building pipes and fittings have been generally in use for rain water pipes, rain water gutters, etc. in buildings. Recently they are also coming into use in drainage work. The manufacture of these pipes in this country is limited at present but is likely to be expanded in view of the large demand we have for rain water pipes and soil and vent pipes in the country, and because of severe shortage of cast iron and steel pipes. The lightness of asbestos cement pipes and their durability makes them suitable for all normal building purposes and in order to encourage its manufacture, the Indian Standards Institution felt it desirable to lay certain standards regarding dimensions and performances of such pipes. Accordingly, the ISI has issued the following two draft Indian Standards:

(1) Specification for Asbestos Cement Building Pipes and Fittings (Spigot and Socket Type) [Doc: BDC 2 (342)] which covers asbestos cement building pipes in diameters 2 in to 6 in for use as rain water pipes, soil pipes or ventilating pipes, also valley gutters, boundary wall (eaves) gutters, half round gutters, ogee gutters and their respective fittings.

The range of sizes and thicknesses covered by the standard have been worked out to suit both the ends of rain water pipes as well as soil pipes and fittings. In UK the rain water pipes, gutters and fittings covered by BS: 569-1956 are lighter than soil pipes and fittings covered by BS: 562-1956. With a view to simplifying the range of these pipes and facilitating their manufacture, the requirements for both the

uses have been combined in a single range of pipes which this standard covers. In doing so, the slightly thicker barrels which will result for rain water pipes, gutter and fittings have been considered to be more than balanced by the advantages gained by simplification in manufacture, stocking, etc.

(2) Specification for Asbestos Cement Pressure Pipes [Doc: BDC 2(346)], which specifies requirements for manufacture, classification, dimensions and acceptance tests for asbestos cement pressure pipes.

This standard mainly follows the ISO Draft Recommendation No. 149 relating to asbestos cement pressure pipes. The agreement reached at the international level on the sizes and pressure ratings of these pipes has been incorporated in this draft Indian Standard and test requirements together with the methods of test have been aligned with the international standard. As considerable quantities of these pressure pipes are likely to be imported into the country, the indigenous manufacture being very small at present, it is hoped that this standard would provide the necessary guide for the purchase of A.C. pressure pipes from different sources abroad.

Indian Standard Specification for Commercial Metric Carat Weights (IS: 1057-1958)

Following the Standards of Weight and Measures Act, 1956, the Indian Standards Institution has been taking steps to help the industry in their smooth change-over to the metric system. Since the existing weights and measures, in use in all parts of the country, are to be replaced by metric weights and measures, within a period of 10 years, the Institution has already issued the following Indian Standards, which have been prepared at the instance of the Standing Metric Committee of the Government of India.

IS:1056-1957	**Commercial Metric Weights**
IS:1058-1957	**Commercial Metric Capacity Measures**
IS:1059-1958	**Commercial Metric Length Measures (Non-flexible)**
IS:1160-1957	**Metric Dispensing Measures**
IS:1269-1958	**Metric Woven Metallic Tape Measures.**

The latest in the series is the Indian Standard Specification for Commercial Metric Carat Weights (IS:1057-1958), which has just been issued by the Institution.

The standard prescribes the requirements for commercial metric carat weights intended for use in weighting pearls, diamonds and other precious stones.

Price : Rs. 1·50

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MADRAS

Licenced Manufacturers, Dealers and Repairers of Weights & Measures

In the September 1958 issue of *Metric Measures* a list of over 300 manufacturers, who claimed to be able to manufacture commercial weights and measures conforming to the respective Indian Standards was published.

From this issue onwards it is intended to give a list of manufacturers, dealers and repairers who have been licenced by the various States under the respective Enforcement Acts to manufacture, deal in and repair metric weights, measures and weighing and measuring instruments.

The following is the list of manufacturers and dealers who have been licenced under the Bombay Weights and Measures (Enforcement) Act, 1958. It appears that the Government of Bombay intend to extend this list as metric weights and measures are introduced in further areas of the State.

BOMBAY

Manufacturers

Sl. No.	Name and Address of Manufacturer	Details of Articles Manufactured
(1)	Avery Co. of India Private Ltd. 16, Dougall Road, Ballard Estate, Bombay-1.	Cast Iron Weights, Bullion Weights, Beam Scales, Counter Machines, Platform Machines, Weighbridges, Petrol Pumps, Linear Measures.
(2)	B. G. Shinde and Company, 735, Shukrawar Peth, Poona-2.	Cast Iron Weights, Brass Weights.
(3)	Imperial Iron Works, Kumbharwada, Kharwa Galley, Bombay-4.	Cast Iron Weights (5 kg to 50 kg).
(4)	M. Nazir & Sons, Duncan Cross Lane, Kazipura, Haji Kasam Chawl, No. 18, Bombay-8.	Cast Iron Weights, Brass Weights, Counter Machines.
(5)	R. F. Panchal, Lal Akhada, Near Sarasia Tank, Fatehpura Baroda.	Cast Iron Weights; Bullion Weights, Capacity Measures.
(6)	Ripon Road Iron Foundry, Lamington Road, North Allana Compound, Opposite Agripada Police Station, Bombay-11.	Cast Iron Weight (2 kg to 100 kg).
(7)	Saple's Scale Mfg. Co. Private Ltd. 7, Prospect House, 29th Raghunath Dadaji Street, Bombay-1.	Brass Weights, Weighing Instruments, Beam Scales Class A, B, C, D.
(8)	Standard Manufacturers, 278/3, Narayan Peth, Poona-2.	Cast Iron Weights.
(9)	Union Metal Works, 28/30, A. Dhaku Prabhu Wadi, Ghorapadeo, Bombay-10.	Cast Iron Weights.

Dealers

Sl. No.	Name and Address of Dealer	Details of Articles Sold
(1)	Avery Company of India (Private) Ltd., 16, Dougall Ballard Estate, Bombay-1.	Weights, Measures, Weighing Instruments, Measuring Instruments.
(2)	B. G. Shinde & Company, 735, Shukrawar Peth, Poona-2.	Weights, Measures, Weighing Instruments.
(3)	Damodar Bhikhabai Kantawala, 4A, Musjid Siding Road, Opposite Sailors' Home, Dana Bunder, Bombay-9.	Weights, Weighing Instruments.
(4)	Esufali Hasanji Mansawala, Mutton Street, Shop No. 169, Bombay-3.	Weights, Measures, Weighing Instruments.
(5)	Fakhir Hardware Scale Mart, 151, Mutton Street, Bombay-3.	Weights, Measures, Weighing Instruments.
(6)	Fakhrudin Abdulhusein Chandurwala, 203-A, Mutton Street, Bombay-3.	Weights, Measures, Weighing Instruments.
(7)	Hindustan Scale Company, 186-188, Janjikar Street, Bombay-3.	Weights, Measures, Weighing and Measuring Instruments.
(8)	Mahakali Sewing Machines and Iron Works, Station Road, Nandol, Dehgam, Dist. Ahmedabad.	Weights, Measures, Weighing Instruments.
(9)	Misrilal Motilal, 71, Sarang Street, Bombay.	Weights, Measures, Weighing Instruments.
(10)	M. Nazir & Sons, Haji Kasam Chawl, No. 18, Duncan Cross Lane, Bombay-8.	Weights, Weighing Instruments.
(11)	N. J. Mehta & Company, 10, Keshavji Naik Road, Chinch Bundar, Bombay-9.	Weights, Measures, Weighing Instruments.
(12)	Rajkamal Scale Company, 154, Janjikar Street, Nimakwala Bldg., Bombay-3.	Weights, Measures, Weighing and Measuring Instruments.
(13)	Ripon Road Iron Foundry, Lamington Road North, Allana Compound, Opposite Agripada Police Station, Bombay-11.	Weights.
(14)	F. R. Panchal, Opposite Bhadra Kacheri, Baroda.	Weights, Measures, Weighing Instruments.
(15)	Saple's Scale Manufacturing Company, 7, Prospect House, 29, Raghunath Dadaji Street, Bombay-1.	Weights, Measures, Weighing Instruments, Measuring Instruments.
(16)	Shrikrishna Company, 738, Shukrawar Peth, Poona-2.	Weights, Measures, Weighing Instruments.
(17)	Standard Manufacturers, 278/3, Narayan Peth, Poona-2.	Weights, Measures, Weighing Instruments.
(18)	Standard Mechanical and Iron Works, 197, Cutlery Bazar, Janjikar Street, Bombay-3.	Weights, Measures, Weighing and Measuring Instruments.
(19)	Union Metal Works, 28/30 A, Dhaka Prabha Wadi Ghorapadeo, Bombay-10.	Weights, Measures, Weighing Instruments.
(20)	Vasanji Devji Rajani, 142, Upper Duncan Road, Bombay-8.	Weights, Measures, Weighing Instruments.

CONVERSION OF WEIGHTS FOR ORDINARY PURPOSES

(4)		(3)		(2)		(1)	(N)	(1A)		(2A)		(3A)		(4A)	
tons	cwt	mds	seers	seers	tolas	tolas	Number	grams	milli grams	kilo grams	grams	quintals	kilo grams	metric tonnes	kilo grams
1	0	2	27	1	6	0·09	**1**	11	664	—	933	—	37	1	16
1	19	5	14	2	11	0·17	**2**	23	328	1	866	—	75	2	32
2	19	8	2	3	17	0·26	**3**	34	991	2	799	1	12	3	48
3	18	10	29	4	23	0·34	**4**	46	655	3	732	1	49	4	64
4	18	13	16	5	29	0·43	**5**	58	319	4	666	1	87	5	80
5	18	16	3	6	34	0·51	**6**	69	983	5	599	2	24	6	96
6	18	18	30	7	40	0·60	**7**	81	647	6	532	2	61	7	112
7	17	21	17	8	46	0·69	**8**	93	310	7	465	2	99	8	128
8	17	24	5	9	52	0·77	**9**	104	974	8	398	3	36	9	144
9	17	26	32	10	57	0·86	**10**	116	638	9	331	3	73	10	160
19	14	53	23	21	35	1·71	**20**	233	276	18	662	7	46	20	321
29	11	80	15	32	12	2·57	**30**	349	914	27	993	11	20	30	481
39	7	107	7	42	69	3·43	**40**	466	552	37	324	14	93	40	642
49	4	133	38	53	47	4·29	**50**	583	190	46	655	18	66	50	802
59	1	160	30	64	24	5·14	**60**	699	828	55	986	22	39	60	963
68	18	187	22	75	1	6·00	**70**	816	466	65	317	26	13	71	123
78	15	214	14	85	59	6·86	**80**	933	104	74	648	29	86	81	284
88	12	241	5	96	36	7·72	**90**	1049	742	83	979	33	59	91	444
98	8	267	37	107	14	8·57	**100**	1166	380	93	310	37	32	101	605

How to use the Table:

(1) Find the required number from Column(N)

(2) Look up the required value under appropriate column.

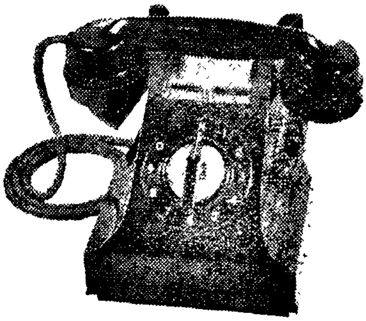
(3) Columns(1) and (1A), (2) and (2A), (3) and (3A), (4) and (4A), should be read together. For example, values form (1) and (1A) can be converted but not from (1) and (2A).

Based on IS:1020—1957 Indian Standard Conversion Tables for Ordinary Use

Example:

(1) To convert 20 tolas into grams and milligrams, look up 20 under column(N) and find the equivalent under(1A) *viz.* 233 grams, 276 milligrams. For converting 20 grams look up under column 1. The value is 1·71 tolas.

(2) To convert 50 kilograms into seers, look up 50 under cloumn (N) and find the equivalent under column (2), *viz.*, 53 seers, 47 tolas. To convert 50 seers look up under column 2A. The value is 46 kg and 655 grams.



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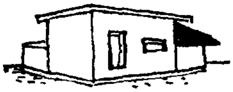

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